

# MONTHLY WEATHER REVIEW,

APRIL, 1881.

(General Weather Service of the United States.)

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WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

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## INTRODUCTION.

In preparing this REVIEW the following data, received up to May 20th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 136 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 183 monthly journals and 177 monthly means from the former, and 15 monthly means from the latter; reports from 5 Sunset stations; 220 monthly registers from Voluntary Observers; 64 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from the local Weather Services of Iowa, Nebraska and Missouri, and of the Central Pacific Railway Co.; reliable newspaper extracts; special reports.

## BAROMETRIC PRESSURE.

The distribution of mean atmospheric pressure over the United States and Canada for the month of April, 1881, is shown by isobaric lines (in black) upon chart No. II. The region of lowest pressure remains about stationary over New England and the Maritime Provinces, but with barometric readings somewhat lower over the latter section than for any previous April since 1874. The regions of highest pressure occupy the Eastern Gulf coast and the Northern Pacific coast region. Compared with April, 1880, the distribution of pressure is about the same, except that the area of high is less marked and the area of low more confined. The latter, extending westward to the Missouri valley in April, 1880, is entirely superseded in the present month by an increase in the extreme of  $+0.2$  inch, and over the Lake region of  $+0.12$  inch.

*Departures from the Normal Values for the Month.*—Throughout the interior of the country the pressure is everywhere above the normal, being most marked in the Upper Mississippi and Missouri valleys and in the Middle Slope, where the departure varies from  $+0.06$  at St. Louis, La Crosse, St. Paul and Dodge City to  $+0.1$  at Bismarck and  $+0.12$  at Yankton. The deficiency of pressure for the north coincides with the regions of greatest departure from the normal, viz.: in the Middle Atlantic and New England States and particularly along their coasts. Departures vary in the interior from  $-0.03$  at Lynchburg and Washington to  $-0.07$  at Burlington, Vt., and  $-0.08$  at Philadelphia; from  $-0.04$  at Cape Henry and Cape May to  $-0.14$  at Portland and on summit of Mt. Washington, and  $-0.17$  at Eastport. Throughout the Pacific States the pressure is below the normal, ranging from  $-0.04$  at Portland to  $-0.07$  at San Diego and  $-0.12$  at San Francisco. On summit of Pike's Peak the departure is  $-0.11$ . The line of no change is not continuous, only three stations in extreme parts of the country, viz: Punta Rassa, Jacksonville and St. Vincent, reporting a normal condition.

*Barometric Ranges.*—The range of pressure during the month has varied in the extremes from 0.25 inch at San Diego to 1.37 inches at Eastport, and 1.38 inches at Ft. Buford. Ranges of 1.00 and above were reported from the following stations: New York City and Albany, 1.00; Ft. Sill, 1.01; Henrietta, Tex., and Burlington, Vt., 1.02; North Platte, 1.03; Springfield, Mass., and Moorhead, Minn., 1.05; New London, 1.06; Ft. Gibson, 1.07; Kittyhawk and Yankton, 1.08;

Thatcher's Island, 1.1; Ft. Elliott, 1.12; New Shoreham, 1.13; Hatteras, 1.15; St. Vincent, 1.16; New Haven and Boston, 1.17; Dodge City, 1.18; Portland, Me., 1.2; Newport, 1.21; Mt. Washington, 1.22; Wood's Holl, 1.32. In general the range has been greatest from Texas north-eastward to New England, the latter district being the only one where the range at every station was above 1.00 inch. Throughout the country, except from Texas directly northward, the range increases with the latitude. As compared with past months, there has been a marked increase of range over the Florida Peninsula, varying from 0.11 to 0.17 inch. Along the southern boundary of the country the range increases from the southwestern and southeastern extremes (California and Florida) inward to the maximum in Texas, while over the northern boundary two maxima were reached, one in New England and the other in the extreme Northwest.

*Areas of High Barometer.*—Five such areas for the month of April have been sufficiently marked to merit a brief description, though none have exercised any special influence over the climatic conditions of the country. The minimum temperatures of the month in the interior of the country, occurring on the 1st and 2nd, are associated with high-area No. I. The minimum temperatures in the Middle States and New England, occurring on the 5th, 6th and 7th, are associated with a great depression then central over the Gulf of St. Lawrence, and extending into the districts named. A deficiency of both pressure and temperature was reported from New England and the Middle States.

No. I.—This is a continuation of high area No. II, described in the March REVIEW. At the morning report of the 1st the highest pressure extended from Manitoba to Indian Territory, the highest reading being at Moorhead, Minn., 30.58. During the day the high area moved southward, and on the 2nd it extended over the Gulf States, with diminishing pressure. In connection with this area the minimum temperatures for the month were reported, on the 1st, in Manitoba, Missouri, Wisconsin, Illinois, Indiana, the Ohio valley, Indian Territory, and on the 2nd, in Tennessee, the Gulf and South Atlantic States. The two lowest temperatures were at St. Vincent,  $-14^{\circ}$  and Moorhead,  $-13^{\circ}$ .

No. II.—During the movement of high area No. I, to the south on the 1st and 2d, the pressure, although diminishing, remained above the normal in Dakota and Manitoba, but on the 2d a marked rise took place in the Saskatchewan valley, and on the 3d the high area extended from Montana and Dakota to Texas, the highest readings being reported from the Missouri valley. On the 4th the highest barometers were reported from the Southwest, but on the ensuing day this area ceased to continue as a high pressure. In connection with this high area a maximum velocity of 51 miles from the northeast was reported from Indianola.

No. III.—On the 7th and 8th, after the passage of low area No. I, to the eastward, there was a great and general rise in pressure west of the Mississippi River. On the 8th the highest barometer extended from Manitoba to Indian Territory. On the 9th the highest pressure was in the Lower Missouri valley, but the area of high barometer extended to the Gulf. On the 10th the high area was divided by the approach of low barometer No. II, then moving over New Mexico and Northern Texas, one portion of the high area moving over the Gulf States and disappearing on the 11th, the other, remaining quite persistently over Manitoba and Dakota on the 10th and 11th, moved on the 12th, to the south, becoming central in western Texas, where, at the midnight report, the pressure was generally 0.4 inches above the normal. On the 13th the high pressure continued the movement to the south, the highest readings being reported from the valley of the Rio Grande. Cautionary Off-shore Signals displayed at Indianola were justified by a maximum velocity of 47, N.

No. IV.—On the 18th there was a decided rise in pressure over the Northwest and Lake region. On the 19th the highest barometer was transferred to the valley of the St. Lawrence. On the 20th and 21st a belt of high pressure extended north of the 40th parallel and west to the Rocky Mountains. On the 22nd the barometer was generally above the normal east of the Mississippi river. On the 23rd the highest barometer was transferred to the Middle Atlantic coast, where the pressure was in general more than 0.3 inches above the normal. On the 24th the high area moved slowly to the south, disappearing on the 25th before the advance of low area No. VI, moving over the Northwest and entering the Upper Lake region.

No. V.—On the 27th there was a sharp rise in pressure in Oregon and Washington Territory, the barometer averaging at the end of the day nearly 0.3 inches above the normal. On the 28th the high area extended over the Rocky Mountains and thence east to the Upper Mississippi valley. On the 29th the high area moved into the Lake region, with the pressure averaging 0.3 inches above the normal. On the 30th the high area advanced over the Lower Lakes, St. Lawrence valley and the Middle States, the pressure being generally 0.4 inches above the normal.

*Areas of Low Barometer.*—Seven such areas are charted for the month of April, 1881. None are traced from the Pacific coast. Nos. II, III and IV are specially interesting, because No. III was a secondary development of No. II, and No. IV a secondary development of No. III. Of the storms of the month the only one showing great energy was No. IV. Low area No. X, of

the March REVIEW, was traced to Nova Scotia on the last day of that month. The pressure remained below the normal in that region and nearly stationary in position until the 10th, the lowest reported reading being at Chatham at the morning observation of the 4th, 29.05, or 0.8 inch below the normal. In the meantime, low area No. I, in its march to the eastward, skirted the border of this depression, but did not unite with it within the limits of our charts.

No. I.—On the 5th the pressure west of the 100th meridian was generally below the normal, with the lowest barometer in Utah. On the 6th the depression moved, as charted, into southern Kansas, the lowest pressure at the midnight report being at Dodge City, 0.42 inch below the normal. On the 7th the storm centre advanced in an easterly track over Arkansas. At the centre of depression the barometer remained during the day between 0.4 and 0.45 inch below the normal. The following heavy rain-falls were reported for the day: Nashville, 1.75 inches; Memphis, 2.18; Montgomery, 1.43; St. Louis, 2.62. On the 8th the low area proceeded with diminishing energy eastward over Tennessee and North Carolina. On this day the heaviest rain-falls were: Savannah, 1.62 inches; Augusta, 2.15; Charleston, 1.48; Smithville, 1.97; Norfolk, 1.05; Cape Henry, 1.4. Cautionary Signals were ordered in advance of this storm, on the 5th at Indianola and Galveston, on the 7th, from Hatteras to Sandy Hook, and on the 8th from Jacksonville to Wilmington. From Smithville to Chincoteague these were justified by the following maximum velocities: Smithville, 28, E.; Macon, 30, SE.; Hatteras, 30, SE.; Kittyhawk, 31, E.; Cape Henry, 37, NE.; Chincoteague, 35, NE. The general track of this storm was slightly to the south of east. During its progress over the country an area of low barometer was central in Nova Scotia, and this area showed the tendency, before noted in the March REVIEW, to skirt the edge of the greater depression, and not to unite with it.

Nos. II, III and IV.—These three depressions should be described together, as No. III was a secondary development of No. II, and No. IV a secondary development of No. III. No. II.—On the 10th there was a considerable decrease in pressure in northwestern Texas and Indian Territory, showing the development of a low area in that region, which, at the midnight report, was located as indicated on the chart. On the 11th it pursued a northeasterly track over Arkansas and Missouri. The precipitation thus far, was confined to the northeast quadrant of the depression. On the 12th, at the morning report, the centre of low area had moved near Louisville, when the pressure, 29.62, was 0.34 inch below the normal. At the morning report the pressure in Nova Scotia was below the normal, the isobar of 29.8 enclosing Chatham, Halifax and Sydney; in the United States the isobar of 29.8 included the Ohio valley and Lake Erie. The low areas above referred to were divided by a belt extending from northwestern New York to Rhode Island, where the pressure was 30.00; the barometric gradient was slight and the meteorological conditions were not favorable to the development of storm energy. During the day area No. II was filled up by inflowing air. In the meantime, during the passage of No. II to the eastward, the barometer had remained below the normal and falling in Texas, and at the a. m. report of the 12th, the circulation of the winds indicated the formation of a new and independent centre of depression in northern Texas and Indian Ty., which, during the day extended northeastward into Tennessee and the Ohio valley. On this day the following great falls in temperature for the preceding twenty-four hours were reported: Ft. Elliott, 28°; Ft. Sill, 46°; Ft. Gibson, 37°; Concho, 31°; Stockton, 26°; Dennison, 29°; Little Rock, 22°; Memphis, 26°; Cairo, 25°; St. Louis, 21°. On the 13th, with diminishing energy, the storm centre passed off the Middle Atlantic coast. On this day the cold wave, before noticed, moved to the southeastward, the temperature falling 20° at Louisville and Knoxville, 21° at Nashville, 23° at Chattanooga, 25° at Memphis, 26° at Vicksburg, 27° at Shreveport and 23° at Montgomery.

No. IV.—On the 13th, during the passage of No. III over the Middle Atlantic States, the barometer remained low and falling in Georgia and the other South Atlantic States, accompanying the development of a secondary depression No. IV, which is charted on the afternoon of that day as central in Northern Georgia. At midnight the centre of the depression had advanced into South Carolina. On the 14th the storm centre, passing beyond the coast, moved with an extraordinary increase of energy in a track nearly parallel to the coast; the lowest barometer was reported from Hatteras, 29.24, or 0.7 inch below the normal. The following maximum wind velocities were reported during the day from the North Carolina coast: Hatteras, 60, N.; Kittyhawk, 76, NE. The following heavy rain-falls occurred during the day: Wilmington, 1.37 inches; Smithville, 1.67; Macon, 3.04; Hatteras, 4.83; Kittyhawk, 2.77. On the 15th, with a great development of energy, the storm pursued a northeasterly track as charted; at Eastport, at the p. m. report, the barometer was 28.81 or 1.05 inches below the normal. At the same report at Yarmouth, the pressure was 0.1 lower, or 28.71. The decrease in pressure for sixteen hours at Eastport was 0.92 inch, and at Yarmouth, 0.95 inch. On the 16th, the storm centre disappeared beyond the Gulf of St. Lawrence. For these storms, in advance of low area No. II, Cautionary Signals were displayed on the 11th along the Atlantic coast from Hatteras to New York, and on the Lakes from Buffalo to Milwaukee. The following maximum velocities were reported: Hatteras, 38, S.; Kittyhawk, 30, SW.; Cape Henry, 29, S.; Norfolk, 28, SW.; Chincoteague, 32, S.; Delaware Breakwater, 36, SW.; Cape May, 28, S.; Sandy Hook, 33, E.; Sandusky, 32, NE.; Toledo, 29, N. The Cautionary Off-shore Signal dis-

played on the 12th at Indianola was justified by a maximum velocity of 47, N. In advance of low area No. III, Cautionary Signals were displayed on the 14th from New Haven to Boston, which were only justified at Thatcher's Island and Boston. In no part of its course did depression No. II exhibit any special energy. In advance of low area No. IV, Cautionary Signals were displayed on the 14th from Cape Henry to Eastport, and Cautionary Off-shore Signals from Savannah to Macon; during the storm, Cautionary Signals were changed to Cautionary Off-shore Signals from Cape Henry to Portland. The following are the maximum velocities reported: Cape Henry, 52, N.; Norfolk, 35, N.; Chincoteague, 39, NW.; Delaware Breakwater, 45, N.; Cape May, 43, NW.; Atlantic City, 27, NE.; Barnegat, 40, N.; Sandy Hook, 38, NE. and 40, NW.; New Haven, 26, N.; New Shoreham, 60, NE.; Newport, 30, NW.; Wood's Holl, 36, NW.; Boston, 34, NE.; Thatcher's Island, 55, NE.; Portland, 35, NE.; Eastport, 52, NE.; Savannah, 33, NW.; Smithville, 28, N.; Macon, 52, N.

No. V.—On the 14th, while low area No. IV was pursuing its course along the Atlantic coast, a depression of slight energy, moving in a southeasterly track from Manitoba, entered the Mississippi valley: it was accompanied by light rains in its northwest quadrant, and after the morning report of the 15th ceased to exist as an independent depression.

No. VI.—On the 24th, a depression moving from the Saskatchewan valley, advanced in a southeasterly track over Minnesota. On the 25th the low area moved over Wisconsin and Michigan. On the 26th the centre passed over the St. Lawrence valley and New England. At no point of its track did it exhibit special energy and the rain-fall accompanying it, while general, was light. The only signal displayed for this storm was at Milwaukee, which was justified by a maximum velocity of 28, NW.

No. VII.—The circulation of the winds and the fall and rise of the barometer, showed the passage of a centre of depression to the eastward on the 26th and 27th, as charted. At no time was the centre of low area within the limits of the United States. No signals were displayed for this storm, and at no time did it exhibit special energy within the limits of the chart.

## INTERNATIONAL METEOROLOGY.

Two international charts, Nos. V and VI, accompany the present REVIEW. The former, prepared for the month of May, 1877, is published in accordance with an explanation given in the leading paragraph under *International Meteorology* in the January, 1881, REVIEW; the latter, which has not appeared since December, 1880, owing in part to a delay in the publication of the May, 1879, number of the "Monatliche Uebersicht der Witterung" of the "Deutsche Seewarte," has now been provided for the month of May, 1879, and will make continuous the series of chart No. VI begun in October, 1877, the last of which was published for the month of April, 1879, in the December, 1880, REVIEW.

*Chart No. IV*, will hereafter be discontinued, as it is considered more practical and satisfactory, to study the development and progress of areas of low barometer, based upon later and therefore a more complete collection of ocean and land data, as exemplified in the preparation of chart No. VI, by which it will be replaced. The data for chart No. IV must necessarily be meagre and imperfect, as logs of vessels cannot be examined for the current month, neither can the land reports from stations in Europe and elsewhere over the Eastern Hemisphere, be received in time to make the study of storms as attempted on this chart of much value.

*Chart No. V*, shows the mean pressure, temperature, wind force and the prevailing direction of the wind at 7.35 a. m., Washington, or 0.43 p. m., Greenwich, mean time, for the month of May, 1877, over the Northern, and at certain isolated stations in the Southern Hemisphere. The Atlantic area of low pressure, which in January, 1877, covered the region beyond latitude 55° N., and between longitude 10° and 50° W., passed slowly southeastward, entering continental Europe over the British Isles and the North Sea, reaching the southern portion of Russia and southeastern Austria, where it remained nearly stationary during May, 1877. The lowest pressures of the month were reported from the following stations situated within the low area above named: Hermannstadt, 29.75 (755.6); Kieff, 29.76 (756.0); Lugan, 29.77 (756.3). A second area of low pressure covers the Canadian Maritime Provinces and a portion of the Atlantic north of latitude 50°, the pressures at Heart's Content, Newfoundland, and Godthaab, Greenland, being 29.80 (757.0) and 29.98 (761.6), respectively. The highest monthly mean pressure, 30.10 (764.6), was reported from the following stations: York Factory, Funchall, Kingston, Jamaica and the City of Mexico. Other regions of comparatively high pressure were reported as follows: Honolulu, 30.08 (764.1); Toronto and Kingston, Canada, and Angra, 30.06 (763.5); Wilmington, N. C., and Batavia, 30.05 (763.3), and Stykkisholm, 30.04 (763.1). These pressures give a monthly barometric range of only 0.35 inch, which exhibits a steady decrease since the maximum of 1.28 in January. The regions of greatest cold were found in the neighborhood of the following stations, as indicated by the accompanying thermometric readings given in Fahrenheit's scale: Fort St. Michaels, 34°; Nikolaievsk, on the Amoor, 36°; Godthaab, 37°, and Haparanda, 39°. The prevailing direction of the wind was *westerly* along the Pacific coast of North America, and from